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THE RAINBAND VINDICATED.

BY J. RAND CAPRON, ESQ., F.R.A.S.

(*Continued from p.* 132.)

One important requirement not yet fulfilled is a gauge or micrometer to estimate the tint and width of the rainband or bands. The width may be measured (though with difficulty in small instruments) by some form of moving web or point, but a comparison spectrum for tint is far more difficult to obtain. Mr. Mill made to me a very ingenious suggestion of the use of didymium for this purpose. This gives as a salt in solution, or as a component of glass, an absorption band, varying in tint with the thickness of the quantity of the solution or of the glass, and he proposed to use a sliding wedge-shaped cell or plate, and to adjust this till it accorded with the rainband.

Unfortunately the didymium band falls exactly in the place of a rather strong low sun band, on the more refrangible side of D, and is complicated by it. I propose to avoid this inconvenience by means of a reflecting prism so arranged that the light to pass through the didymium solution or glass shall come from the zenith. For micrometric measurement of the band width, and for comparing the didymium or any other selected band with the rainband, I know of no better arrangement than one illustrated below (fig. 4). In this case the slit plate is divided horizontally in two, and the upper half with its spectrum is made by means of a micrometer screw to traverse the lower half as shown in the diagram (fig. 5).

By this means measurements and comparisons may be easily made, *e.g.*, the D lines in the upper spectrum may be used to measure the width of the rainband in the lower, or the didymium band in the upper may be brought into direct comparison with the rainband. The D line or any other may also be brought over and compared with F or other of the solar lines. All these comparisons are thus rendered less difficult than when the bands and lines are a distance apart.

It has been proposed to place a "condensing lens" in front of the slit, but I do not for ordinary use see any advantage in it. The sky light cannot be condensed, and I doubt whether in any picture

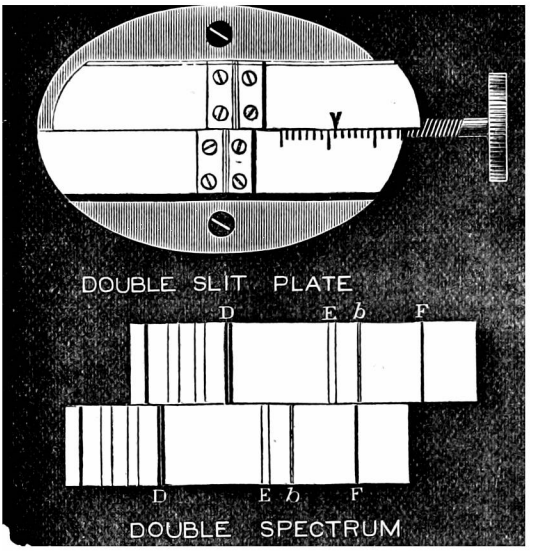


Fig. 4

Fig. 5

formed on the slit of a small spectroscope it would be possible to distinguish a cloud spectrum from that of the sky.

In the case of larger spectroscopes, with considerable slit length, the device might perhaps be more useful.

OBSERVATIONS AND THEIR RESULTS.

As the number of observers, evidenced by the sale of instruments, has increased, so also have the methods, quantity, and quality of the observations.

With regard to the methods, the more simple form of observation recommended by me in the "Plea" has been by some extended, and the lesser rainbands, the dry air bands, and the atmospheric lines other than D have all been enlisted into service. By the varying thickness and appearance of these, the judgment obtained from the larger rainband near D has been reinformed and strengthened.

Much information on this head will be found in Mr. Cory's "How to foretell."

That observer, too, has extended his scale from Prof. Piazzi Smyth's 10 to 20. After much experience, I still think the scale given in the "Plea," 0 to 5, is the more useful for general observers, except that I have introduced 0–1 as indicating a very faint band. Mr. Cory says "the rainband is never absent." This may be strictly true, but it is more convenient in practice to begin with 0 as indicating all that is seen in dry fine weather.

Mr. J. A. Bramley Moore in a letter to *Knowledge*, No. 60, p. 485, remarks:—"(2) If the sun lines in the green instead of appearing clear and distinct are thick and muddy, heavy rain (like thunder rain) will follow, and this whether there is any "rainband" in the red or not.

"(3). If on moving the spectroscope slightly to the left the "blue" appears very light, and the dark line down is clearly seen, then wind may be expected." He adds that this "never fails."

"(4) On one occasion on moving the spectroscope as above, the green instead of giving way to the blue, seemed to fight with it, and *pass over it.* A thunderstorm followed."

Twice since he found the same thing to occur. Mr. Cory, p. 30, corroborates this form of thunderstorm prediction.

Mr. Cory also notices that the rainband decreases before snow, and his diagram on Plate III. illustrates this.

He also recommends pointing the spectroscope to the direction from which the wind comes; a useful suggestion.

Coming now to the question of how far the spectroscope makes good its predictions, we have :—

(1) General evidence as afforded by the statements of Prof. Piazzi Smyth, Mr. Cory, Mr. Mill, Mr. Clapham, and others, who have borne testimony in favour of its value for forecasting.

(2). Recorded sets of observations, either daily or as averages for longer periods; and either in figures, or as lines and curves, expressing the result in a graphical form.

In a letter to the *Times* of September, 23, 1882, Prof. Piazzi Smyth gives a fortnight's notes, September 1st to 15th, 1882, in three columns—(1) Temperature, (2) Rainband intensity, (3) Rainfall at the Royal Observatory, Edinburgh. A glance at these will show how rain fell as the rainband increased, and how some small successive rainbands led up to a fall of rain.

Mr. Cory has not given statistics in his book, but in a letter to the *Times*, February 1st, 1881, he gives a list of observations taken at 9.15 a.m. daily for the month of January of that year. The results are as follows :—

1	case of	70%	rainband	was	followed	by	heavy rain.
2	cases of	60%	„	„	„	„	rain in both.
8	„	50%	„	„	„	„	rain every time.
7	„	40%	„	„	„	„	rain in 5, overcast in 2 cases.
9	„	30%	„	„	„	„	6 of rain.
1	case of	40%	decreasing to	30%	was	followed	by nimbus.
1	„	30%	increasing to	40%	„	„	„ rain.
1	„	20%	„	„	30%	„	„ „ slight rain and heavy snowfall.
1	„	20%	was followed by very fine weather.				

31 days.

These figures seem to be conclusive as to the rainband's predictive value.

To Mr. Cory I am also indebted for the graphical chart, a copy of which I give on Plate I., showing the mean per-centage of rainband

in dotted curves, and the amount of rainfall in vertical lines for each month during the year 1882 and a part of 1883, at Buckhurst Hill, Essex. The observations were taken in the N. direction, three times a day, and at an angle of from 10 to 20 degrees above the horizon. As Mr. Cory remarks in his accompanying letter to me, "there is a decided connection between the two." The high per-centage of rainband in June and July, with a not excessive fall, is due to the rainband being stronger in summer. The heavy fall in the later half of October was preceded by a very high mean rainband during the first half of the month. Of the fall in March, with a low rainband, half was snow, and the actual amount of rain was very small.

These apparent discrepancies are consistent with the rainband laws.

Mr. Mill, in his "The Rainband," gives a graphical chart and some tabular statements showing how his rainband predictions were fulfilled.

Tables II., III. and IV. in that work give the results when the rainband was compared in intensity with the Fraunhofer lines, *b* and *F*, during seven months of 1882.

These tables show there was 8 per cent. of cases when the rain *did not*, and 92 per cent. of cases when the rain *did*, follow maximum rainband; and 21 per cent. of cases when the rain *did*, and 79 per cent. of cases when the rain *did not* follow a minimum rainband.

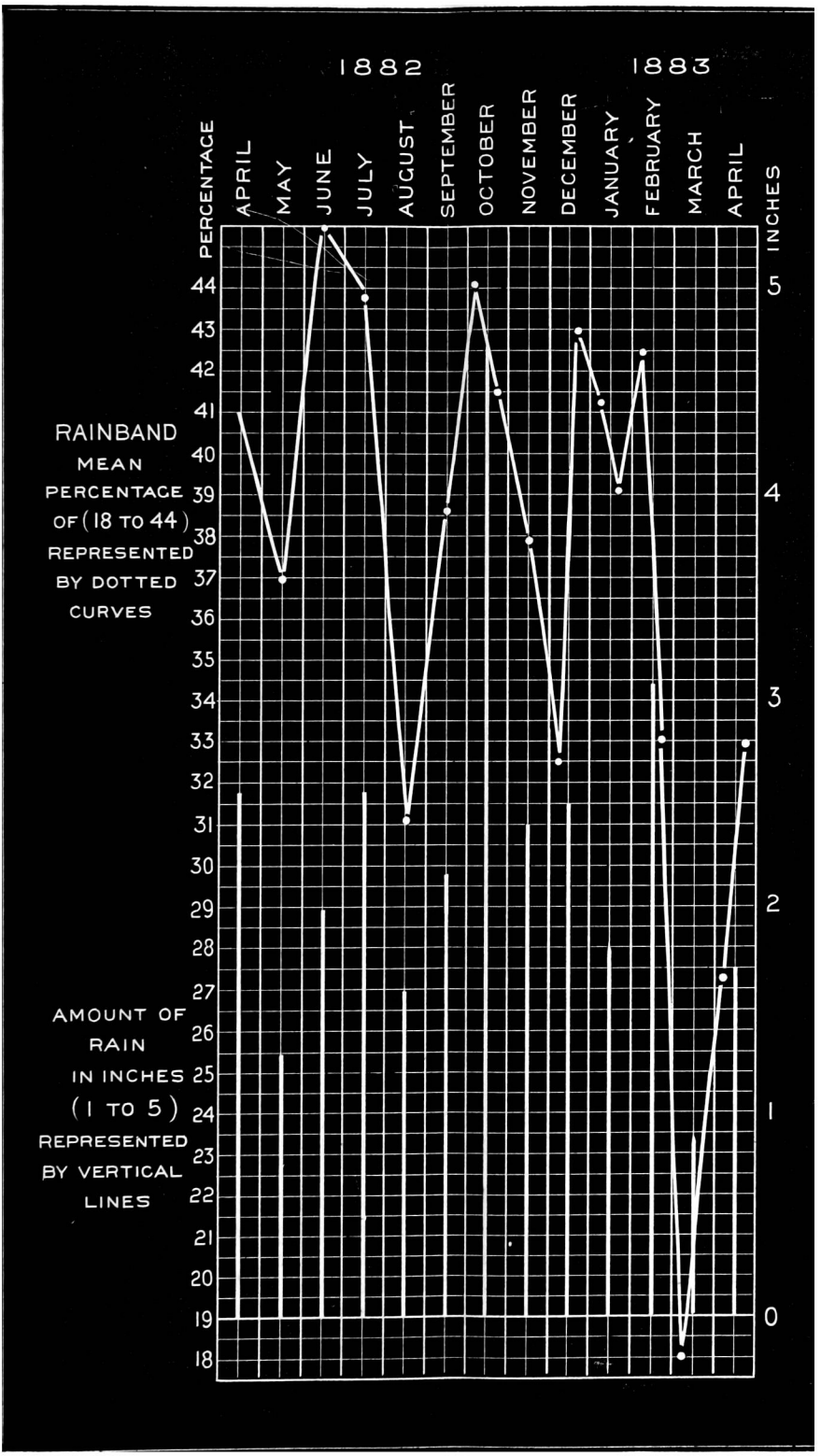
Table V. gives the result of observations made in Callander for the months June to December, 1882:—

Rain predicted	125
Rain followed	97
Per-centage of fulfilled predictions ...	78
No rain predicted...	80
No rain followed	51
Per-centage of fulfilled prediction	64
Total predictions	205
Total fulfilments	148
Per-centage of total fulfilled predictions...	=72

Table VI., for January to September, 1883, gives the total of fulfilled predictions at 209, and of unfulfilled 64. Per-centage of fulfilled predictions = 76·5.

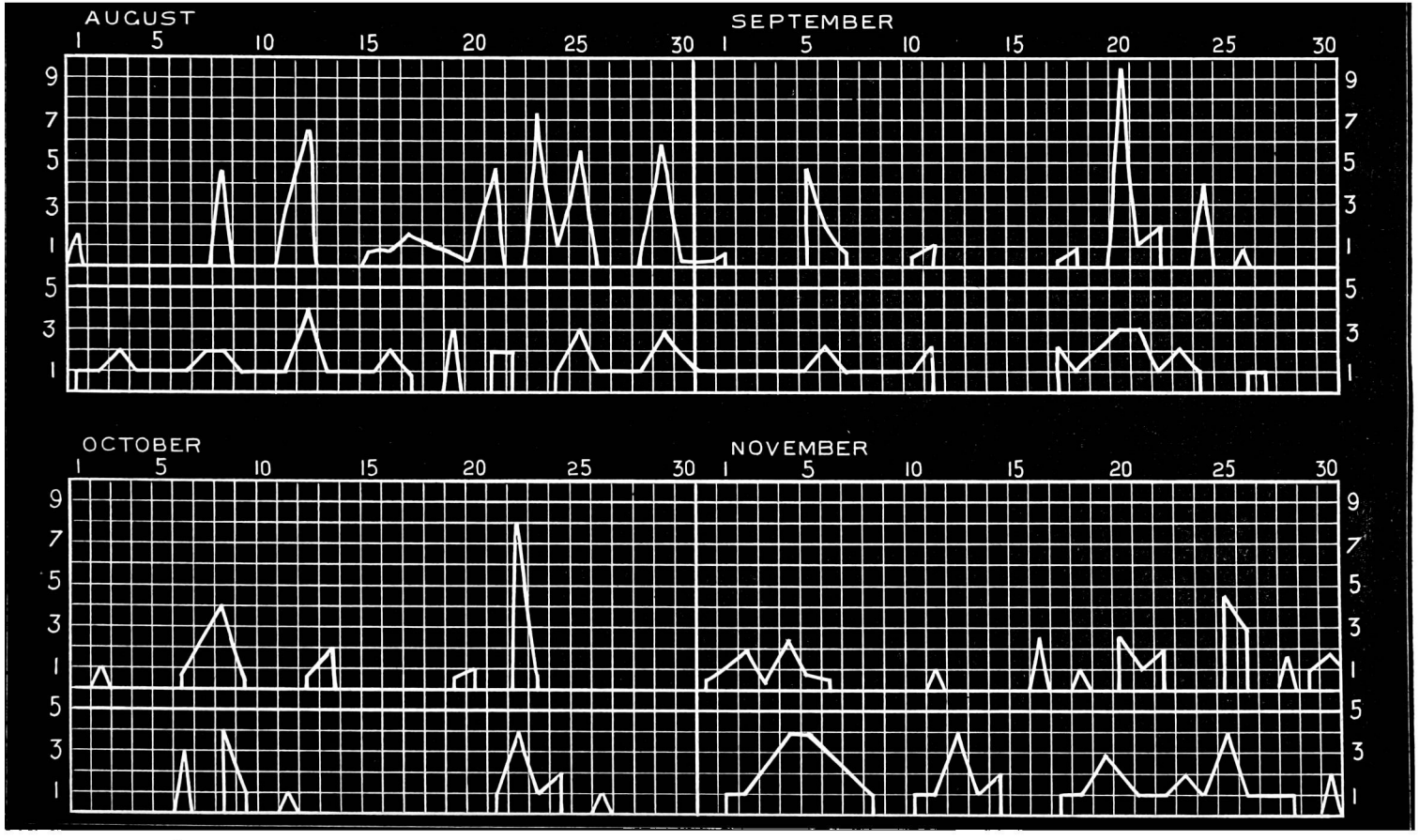
With respect to the Guildown observations, these have been taken since the 1st of July, 1880, at 9 a.m. daily, with the spectroscope, and in the manner mentioned in the "Plea." All the barometric and other meteorological observations for a half year are from time to time reduced to curves upon a chart, in which, in tenths of inches, the days of the year form the abcissæ, while the readings of each instrument form the ordinates. In these the rain is shown in tenths of inches of fall, and the rainband in degrees of strength 0—1 to 5.

PLATE I.



MONTHLY RAINFALL AND RAINBAND, 1882-3.

Plate II.



RAINFALL AND RAINBAND AT GUILDOWN FOR FOUR CONSECUTIVE MONTHS OF 1881.

The rainfall and rainband portion of the chart for four consecutive months of 1881 is shown in Plate II.

These charts if put together would extend to a length of 12 feet 2 inches, and comprise over 1,800 observations. I have not tabulated the results except for yearly values, but a glance at the curves ought to convince the most sceptical that the connection between the rainband and rainfall is, as a general rule, well established.

The yearly values run out thus :—

Table of Yearly Values of Rain and Rainband.

Year.	Rainfall in inches.	Rainband in numbers.	
1881.....	25·68	353·5	
1882.....	28·10	392·5	1·0 of Rainband
1883.....	24·35	404·5	= ·60 of Rain.
1884..... ..	18·70	314·0	

It is obvious that if such a method of long-period comparison as this shows an approximate reciprocal rise and fall in the total values of rain and rainband it is as much as can be expected from it. If special circumstances prevail, such as fogs and mists, which give a low rainband without rain, we may expect to find (as in 1883 and 1884) an advance of total rainband over rain for that year.

Other observers doubtless have preserved records which have not come under my notice ; but taking Mr. Cory's, Mr. Mill's, and the Guildown ones alone, I think the fact is established that the little dark "bar" in the yellow of the spectrum can well hold its own in forecast with any other "bars," and that its character has been amply vindicated.

It now only remains to refer to one or two meteorological subjects allied to the rainband, but not generally finding a place with the observations of pressure, temperature, wind, &c. These are ozone, atmospheric electricity, and the weather compass for forecasting invented by the late Prof. Klinkerfues.

THE RAINBAND AND OZONE.

Mr. Cory, in his "How to Foretell," (p. 32) remarks that the blue and yellow colours in the spectrum are useful guides to the presence or absence of ozone. If the air is very pure, the blue will be clear, and F will stand out distinctly, while the yellow will show itself as a true colour or have an orange tint. If the reverse, the yellow will have a greenish hue, and the blue will be deep and dark, with an indistinct F.

I have not particularly observed these colour changes, but the meteorological charts above mentioned contain ozone curves on the same principle as those of the rainband, and for similar periods. The

scale for rainband is, as before, 0–1 to 5; that for ozone 1 to 10 of Negretti and Zambra's scale for their iodide of starch papers. A portion of one of the charts comprising four months (the first of each quarter of 1882) is given in Plate III. An examination of this will show that generally the curves of rainband and ozone agree in rising and falling together. It does not often occur that ozone is nil; but when it is, rainband also is found absent. This is indeed what might have been expected, for with warm winds, W. and S., the rainband is reinforced; with cold winds, N. and E., it is depressed. A similar effect, but even more regular in its action, is found with the ozone tests. Thus a S.W. wind gives the strongest tinted papers; a N.E. wind the lightest. We know so very little of ozone and its properties that it would not be safe to connect its quantity in the air with conditions of moisture, though such a connection may be fairly suspected.

Guildown is remarkable for exceeding in average quantity of ozone places situate much nearer the sea. This is probably due to its altitude of 225 feet, and to an open valley to the W. from which there is a prevalent air current.

ATMOSPHERIC ELECTRICITY.

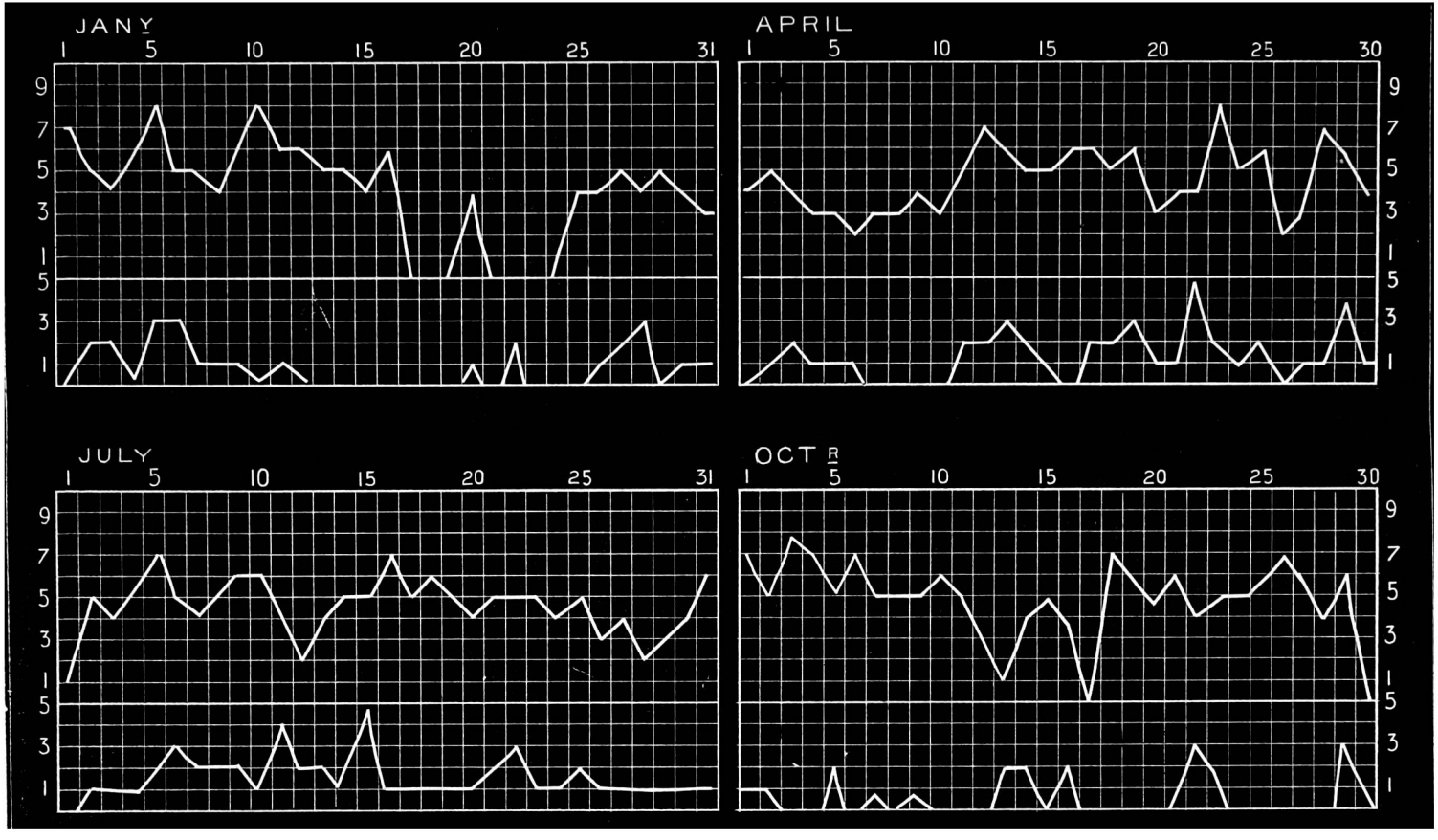
In the "Plea" I suggested that observations of atmospheric electricity might usefully accompany those of rainband. The relation of these to each other becomes more apparent when the influence of electricity upon aqueous particles is considered, and how the size of these latter determine the strength of the rainband.

When these are minute in the form of transparent water vapour, evidenced only by the hygrometer, the rainband is strong. When the particles are larger in the shape of visible fog or mist, the rainband considerably weakens. Lastly, when the gross particles fall as heavy rain-drops or snow-flakes, there is frequently no rainband, or hardly any. Now, the property of atmospheric electricity (as shewn in the familiar experiment of a sponge suspended from the prime conductor of an electrical machine) is, when developed, to cause the finer cloud particles, by mutual repulsion in the first instance, to coalesce and descend as rain. Electric action is always strongly marked when rain suddenly falls, even to the extent of yielding sparks from a properly insulated conducting wire, and it has evidently much to do with the breaking up of clouds. I have not traced, as Mr. Moore and Mr. Cory have, a forecast of storms by the aspect of the rainband, or the colours of the spectrum, but I have noticed a sudden increase of atmospheric electricity, and a weakening of the rainband frequently to accompany a clearing shower.

Those who desire to combine observations of atmospheric electricity with those of the rainband, will find the mode and the apparatus used fully described and illustrated in the *Meteorological Magazine* for August and October 1885.

The collecting is effected by means of elevated points, or a water stream, and the examination by a Bohnenberger suspended gold leaf

Plate III.



OZONE AND RAINBAND AT GUILDOWN FOR FOUR MONTHS OF 1882.

electrometer; or by a Thomson's quadrant electrometer, excited by a chloride of silver battery.

KLINKERFUES' WEATHER COMPASS.

Lastly, I have to notice an instrument invented by the late Prof. Klinkerfues, of Göttingen, for the purpose of weather forecast. It is an ingenious combination of an aneroid barometer, a string hygrometer, and a wind scale, jointly affording indications of the effects of pressure, moisture and wind. A general idea of its construction will be obtained from the annexed wood-cut.

In this drawing—*a* is the aneroid vacuum box; *b*, moveable weather scale; *s*, moveable wind scale; *c*, hygrometric hair string; *d*, segment actuating index; *e*, lever connecting barometric with hygrometric effects; *f* and *g*, arms to which the hair string is attached; *h*, lower end of index, the upper end of which projects on to the weather scale.

The working arrangement is such that in dry air conditions the hygrometer string acts *with* the barometer for a rise; and in moist weather *against* it; and the two instruments thus combine in a joint reading, depending on the variation of each. When fine weather is approaching, the hygrometer will give the barometer an extra "pull up," and in moist assist it in "a fall," while at times the two may balance one another.

In this way more variation is obtained than with the ordinary barometer, and the concurrent effects of pressure and moisture are read off.

To forecast, the method is this—

At any definite time, say 9 a.m., set the outer dial with the words describing the weather, "Rain," &c., with the inner wind dial, so that the word denoting the prevailing weather will stand against the wind direction at the time, *e.g.*, set the centre of the larger dial "Change" against the centre of the wind dial "North;" then turn *both* dials *together*, until the index covers the words "Change" and "North." Twelve hours after, we will suppose the index to have risen to "Fair," and the wind to have changed to the "West." We must now move the outer dial *only* in the wind direction, so as to correspond with the pointer "West."

This will bring "Change" again under the index, and indicate that the prospect of fair weather shown by the index rise has been neutralized by the wind change, and changeable weather may consequently be predicted. Had the wind gone Eastward with the index rise, the words "Set Fair" would have taken the place of "Fair," and continuous fine weather would have been foretold. Of course no meteorological instrument is infallible; but I may fairly say that with proper care in setting, much may be made of the "Klinkerfues" for weather forecasting. A friend of mine, a large farmer, has used one for years; and to quote his own words, "I always set my farm work by it."

To prevent disappointment in its use, it is necessary to remember:—

1. That its movements are relative, and are not intended to compare with those of the barometer, being on nearly twice the scale, and acted upon hygrometrically.

2. It must be set each time as before described for a forecast. If left alone with "Change" at top, the index will sometimes run right off the marked part of the dial, in consequence of the greater range.

When sent from abroad by the patentees (Messrs. Biernatzki & Co., of Hamburg), the index is secured to ensure safe travelling. This has to be released, and then set by a screw at the back of the case, either by a barometer, or to the prevailing weather sign. This setting should not afterwards be altered, the dials being in future adjusted to the index, and not it to them.

How sensitive the hygrometric action is, may be seen by breathing on the back of the case, when the index will at once be in movement.

The instrument, although now introduced some years, has not been so well received as it deserves, owing, as correspondents have told me, to the setting arrangement not being properly understood. It is, however, after a little practice, very simple. Though not in strictness an instrument fully adapted to scientific research (a divided scale would add to its value), it certainly merits attention, if it will only succeed in saving a hay crop, or telling the farmer how long his stacks may remain out, matters as to which his mercurial barometer sometimes misleads him. Probably a better acquaintance with it by meteorologists would more fully develope its qualities as an adjunct to the rainband spectroscope, for which it seems well adapted.

REVIEWS.

Stanford's Parliamentary County Atlas and Handbook of England and Wales. 8vo, 330 pages, 89 maps. London, Stanford.

TRULY we live in times of change; even our geography has constantly to be re-learned, for Mr. Stanford tells us that—

"The new Electoral Divisions, set up by the Redistribution of Seats Act, 1885, have for all Parliamentary purposes superseded the ancient and well-known County; it is therefore important that the area and contents of these new divisions should become generally known, and for this purpose the Atlas and Handbook will be found of great practical value.

"These new Electoral Divisions are based as far as possible upon the hitherto little known Petty Sessional Divisions, which have consequently been brought into considerable prominence. In this Atlas the boundaries and names of the new divisions are marked and written in red, and are further distinguished by various tints of colour."

If this handsome volume had given merely details of population, &c., no matter how good the maps might have been, it would have had little claim on our attention; it would have been indispensable, or nearly so, to aspirants for Parliamentary honours, but meteorologists might have passed it by.

The title is, however, deceptive, not in a bad sense, but in a good one, for the book contains much more than anyone would expect: it contains, besides about 60 county and town maps, the following physical and statistical maps:—Geological Map of Great Britain, Orographical Map of Great Britain; and for England and Wales—River Basins, 24 Maps of Monthly Rainfall, Air, and Sea Temperature and Barometric Pressure, and one each giving the following particulars:— Population, Occupation, Agriculture, Coalfields, Death Rate, Registration Counties, Parliamentary Representation, Dioceses of the Established Church; also maps of the Isle of Man, Jersey, Guernsey, and the smaller Channel Islands.

The non-political portion of the volume is crammed with information, and, carefully studied, would teach most persons much of what they know too little about—their own country.

The first two maps are very suggestive; they are on exactly the same scale, one, the geological, is tinted in accordance with the nature of the soil, the other, the orographical, in accordance with its elevation; and thus the intimate relation between the hardness of the rocks and the altitude of the hills and mountains is at once apparent.

The next map is, for a moment, rather puzzling. It is a geographical map, with the county names, &c., in large type, but it is coloured according to the river basins. Usually in a watershed map the names of the rivers are printed so large, and those of the towns so small, that it is not easy to realise the geographical position of the boundaries. In this map the only special indication of the rivers is well-arranged colouring, and hence one learns a lesson which it is quite possible that even the publisher did not intend to teach. In some cases the lettering is almost amusingly in harmony with the

colour, *e.g.*, Durham, the normal shape of which is very approximately represented by the basin of the river Wear.

We now come to that which really constitutes a very valuable contribution to meteorology, viz., a set of 24 maps—two for each month. They are arranged in pairs, the two for each month lying open at once. They are all on one scale, and represent England and Wales on the scale of about 100 miles to an inch; as, however, they are beautifully engraved, the smallness of the scale is rather an advantage than otherwise.

The information given is—

(1.) On the first map. Monthly isothermals of air temperature, by Alexander Buchan, Esq., F.R.S.E. (who also contributes two pages of remarks upon the maps).

(2). Coloured shading round the coast, showing the monthly mean temperature of the sea, taken, we believe, from the "Meteorological atlas" published by the Meteorological Office.

(3). On the second map. Coloured rainfall maps, prepared from the tables compiled by G. J. Symons, Esq., F.R.S., from the records of 366 stations during the fifteen consecutive years, 1866–80. The accuracy of these maps is only equalled by the clearness of the printing. We wish that every rainfall observer could have a copy, for they are not merely good, but the only maps of the kind in existence.

(4). Isobars for each ·02 inch of atmospheric pressure. These are, we think, based on the same data as (2).

After this series, follows a map, representing the density of population (showing, by-the-bye, one fact of which we were not aware, viz., that the northern part of the county of Nottingham is more populous than much of Lancashire). The next map, by a mode of colouring new to us, gives a mass of information as to the occupations of the people, even specifying the class of fish caught on the various coasts. We must, however, refrain from describing the rest of the maps, and conclude by congratulating the publisher on the success of his work (many portions of which ought to have been compiled by Government), a work which, whether it pays or not, will always redound to his credit.

Crowborough. — Observations upon the Topography and Climate of Crowborough Hill, Sussex, together with other subjects of collateral interest. By C. LEESON PRINCE, M.R.C.S., F.R.A.S., F.R.Met.Soc., &c. Privately printed. 8vo, 1885.

HAVING been carefully through this book, we begin our remarks by expressing regret that a useful and interesting monograph should not be rendered generally accessible by copies being placed for sale in the hands of a publisher.

Mr. Prince has probably done more for Sussex meteorology than any one living or dead. The present book is in some respects a sup-

plement to his larger work on *The Climate of Uckfield*, and we hope that, like it, a new edition of Crowborough will soon be accessible to the general public.

Crowborough is a new, and we think desirable, inland health resort, nearly 800 feet above sea level, and about seven miles south-west of Tunbridge Wells. It is formed of the Hastings Beds (or Hastings Sands, as they used to be called), which rest upon the Great Wealden formation of the south-east of England. The view from many parts of Crowborough, but especially from Mr. Prince's Observatory, is exceptionally fine, and Mr. Prince gives a list of (107) churches and (41) important objects which he has been able to identify. He does not give their distances from Crowborough, but among them we notice :—

Lydd Church, Kent (near Dungeness),	which is	34	miles	E.S.E.
Fairlight Church, Sussex (near Hastings),	,,	25	,,	S.E.
Dyke House, Brighton, Sussex,	,,	20	,,	S.W.
Leith Hill, Surrey,	,,	24	,,	W.N.W.

Altogether we calculate that the landscape must include quite 800 square miles, or about half a million acres.

As regards the climate, Mr. Prince's remarks carry the weight of nearly half a century's experience in continual registration, and of the use of none but the best instruments. Although not himself an admirer of Stevenson's stand, he has kept duplicate records of thermometers exposed according to his own system, and of others in a Stevenson screen. We cannot, in the space here available discuss fully the *pros* and *cons* respecting the exposed thermometers. Mr. Prince has devoted many pages to printing full abstracts of the results, and has thus enabled observers to compare them for themselves. One fact will probably be a surprise to many, viz., that the average daily maximum by a bright bulb mercurial thermometer exposed to the sun 4 ft. above the ground is, even in July, only 5°·7 higher than that in a Stevenson screen, and, on the average of many years, is only 3°·8 higher. The explanation lines in several factors : (1) a bright bulb full of mercury is virtually a spherical mirror, and reflects a very large proportion of the heat it receives ; (2) the bulb is free to radiate its heat to the sky ; (3) the bulb is at times wetted by rain, and then it gives the temperature of the wet bulb instead of that of the dry bulb.

The winter temperature of Crowborough, though low, is very equable, more so even than that of Torquay, Llandudno, or Barnstaple.

The book all through is interesting, useful, and full of suggestive remarks ; *e.g.*, "I have found upon many occasions that the lowest temperature occurs very generally between the hours of nine and ten in the evening, and subsequently shows a tendency to rise without falling again during the night. It is quite possible that this feature obtains generally upon high ground." Yes, very probably ; if so, how desirable to get a thermograph, and to determine the hourly corrections.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	72·8	20	29·3	4	58·4	39·7	39·2	73	112·8	22·3	2·32	11	5·7
Malta	74·2	8	47·8	2	67·3	53·6	51·8	76	130·3	40·8	·59	6	3·2
Cape of Good Hope	90·4	14	41·0	24	72·3	52·8	...	...	...	...	1·92	10	5·0
Mauritius	83·8	13	65·0	26	82·2	71·7	68·0	76	134·5	53·1	1·41	12	4·7
Calcutta	105·3	15	69·6	26	100·0	76·0	71·1	63	159·5	43·3	·66	3	2·3
Bombay	89·5	17	73·7	9	86·0	75·5	71·6	74	144·3	64·0	·00	0	1·1
Ceylon, Colombo	92·4	26	71·8	1	89·9	75·2	71·5	70	145·0	59·5	3·60	11	3·4
Melbourne	83·6	4	40·0	30	66·4	49·4	48·4	74	137·0	32·1	2·52	9	5·8
Adelaide	85·2	10	46·2	29	72·3	53·8	47·3	55	143·1	34·9	·97	8	4·0
Wellington	68·0	1	40·0	24	61·7	48·6	...	...	130·0	36·0	2·76	11	...
Auckland	70·0	8*a*	48·0	24*b*	65·8	53·2	49·8	71	140·0	38·0	·54	12	4·6
Jamaica, Kingston	...	...	...	...	...	...	...	...	...	...	...	...	...
Barbados	83·0	25	68·0	7*c*	80·0	71·0	70·2	75	144·0	...	·85	8	5·0
Toronto	67·3	23	17·8	9	45·7	28·8	30·6	73	120·0	7·5	3·05	11	...
New Brunswick, Fredericton	76·8	24	13·7	11	48·9	27·7	27·0	65	...	...	2·69	9	4·4
Manitoba, Winnipeg	66·0	28	−9·0	2	45·6	25·4	30·0	77	...	...	1·82	11	6·5
British Columbia, Victoria	70·0	11	30·0	18	57·8	37·0	...	...	...	...	·53	5	...

a And 20. *b* And 25. *c* And 8, 9, 13.

Remarks, April, 1885.

Malta.—Mean temp., 59°·5; mean hourly velocity of wind, 10·5 miles; sea temp. rose from 61° to 64°; TS on 11th, L on 3rd, 4th, and 17th. J. Scoles.

Cape of Good Hope.—Max. temp. 0°·7 above average; min. temp. 1°·4 below average. W. Ellerton Fry.

Mauritius.—Rainfall 4·10 in. below average; mean temp. equal to average; prevailing wind S.E. to E. by S.; mean hourly velocity 2·3 miles below average, extremes 22·5 miles on 30th, and 1·6 miles on 28th. T on three days, L on 5. C. Meldrum, F.R.S.

Colombo.—TSS on 6 days, and L on 7 other days. J. H. Symonds.

Melbourne.—Rainfall ·30 in., pressure ·128 in., and humidity 1 above the average; mean temp. of air 1°·5, and of dew point 1°·1, and amount of cloud 0·1 below average; prevailing winds S.W. and S., strong on 3 days; heavy dew on 12 days, dense fog on 4. R. L. J. Ellery, F.R.S.

Adelaide.—Mean temp. (63°·0) 1°·4 below average; mean pressure ·102 in. above average, and the highest during 28 years. The weather of the latter half of the month was delightful, the temp. not exceeding 80°, the sky being unusually free from cloud, and the atmosphere pleasantly humid. W. E. Cooke.

Wellington.—From 1st to 17th fine, bright, and pleasant, with moderate winds from N.E. and S.E.; from 17th to 20th wet and stormy from S.E.; thence to 28th generally fine, bright, and cold; last two days wet. Mean temp. (55°·1) 2°, and rainfall ·85 in. below average. R. B. Gore.

Auckland.—A fine month with rainfall less than one-seventh of the average of 18 years; pressure above the average, mean temp. considerably below it. T. F. Cheeseman.

Barbados.—Rainfall 65 per cent. below the average; mean temp. (75°) average; wind N.E. on 28 days, mean hourly velocity 14·2 miles, extremes 18·3 miles and 8·1 miles; the whole month was cloudless; severe drought after the 16th. R. Bowie Walcott.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1885.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	4·11	XI.	Rhayader, Nantgwillt..	10·05
,,	Margate, Birchington...	4·30	,,	Carno, Tybrith	8·01
,,	Littlehampton	3·70	,,	Corwen, Rhug	6·60
,,	Hailsham	4·84	,,	Port Madoc	6·27
,,	I. of W., St. Lawrence.	3·73	,,	I. of Man, Douglas	4·62
,,	Alton, Ashdell.....	4·27	XII.	Stoneykirk, Ardwell Ho.	2·31
III.	Winslow, Addington ...	3·86	,,	Melrose, Abbey Gate ...	3·42
,,	Oxford, Magdalen Col...	3·89	XIII.	N. Esk Res. [Penicuick]	2·50
,,	Northampton	3·41	XIV.	Ayr, Cassillis House ...	...
,,	Cambridge, Beech Ho...	4·28	,,	Glasgow, Queen's Park.	2·79
,,	Wisbech, Bank House..	4·88	XV.	Islay, Gruinart School..	3·58
IV.	Southend	3·45	XVI.	St. Andrews, Newton Bk	...
,,	Harlow, Sheering	3·82	,,	Balquhidder, Stronvar..	5 95
,,	Rendlesham Hall	5·04	,,	Dunkeld, Inver Braan..	2·40
,,	Diss	4·86	,,	Dalnaspidal H.R.S. ...	5·24
,,	Swaffham	5·57	XVII.	Keith H.R.S.	3·54
V.	Salisbury, Alderbury...	3·71	,,	Forres H.R.S.	2·13
,,	Warminster	3·96	XVIII.	Strome Ferry H.R.S....	6·72
,,	Calne, Compton Bassett	4·31	,,	Lochbroom	7·71
,,	Ashburton, Holne Vic..	9·70	,,	Tain, Springfield.....	1·92
,,	Holsworthy, Clawton...	7·00	,,	Loch Shiel, Glenaladale	9·96
,,	Hatherleigh, Winsford.	8·28	,,	Invergarry	5·97
,,	Lynmouth, Glenthorne.	5·68	XIX.	Lairg H.R.S.	4·67
,,	Probus, Lamellyn	8·69	,,	Forsinard H.R.S.	4·15
,,	Wincanton, Stowell Rec.	4·53	,,	Watten H.R.S.	3·29
,,	Wells, Westbury.....	5·74	XX.	Dunmanway, Coolkelure	4·69
VI.	Bristol, Clifton	4·53	,,	Fermoy, Gas Works ...	2·52
,,	Ross	2·75	,,	Tralee, Castlemorris ...	4·41
,,	Wem, Sansaw Hall.....	5·04	,,	Tipperary, Henry Street	4·68
,,	Cheadle, The Heath Ho.	6·05	,,	Newcastle West	5·74
,,	Worcester, Diglis Lock	3·51	,,	Miltown Malbay.....	3·97
,,	Coventry, Coundon	4·32	,,	Corofin	...
VII.	Melton, Coston	6·34	XXI.	Carlow, Browne's Hill..	2·95
,,	Ketton Hall [Stamford]	5·42	,,	Navan, Balrath	4·03
,,	Horncastle, Bucknall ...	4·95	,,	Mullingar, Belvedere ...	2·88
,,	Mansfield, St. John's St	6·64	,,	Athlone, Twyford	3·77
VIII.	Macclesfield, The Park.	...	XXII.	Galway, Queen's Col....	4·95
,,	Walton-on-the-Hill.....	6·62	,,	Clifden, Kylemore	6·16
,,	Lancaster, South Road.	3·59	,,	Crossmolina, Enniscoe..	6·05
,,	Broughton-in-Furness ..	...	,,	Carrick-on-Shannon ...	3·69
IX.	Wakefield, Stanley Vic.	3·15	XXIII.	Dowra	...
,,	Ripon, Mickley	5·37	,,	Rockcorry.....	3·47
,,	Scarborough.....	4·86	,,	Warrenpoint	3·20
,,	East Layton [Darlington]	5·45	,,	Newtownards	2·40
,,	Middleton, Mickleton ..	4·60	,,	Belfast, New Barnsley .	4·53
X.	Haltwhistle, Unthank..	3·77	,,	Cushendun	5·08
,,	Shap, Copy Hill	6·13	,,	Bushmills	3·55
XI.	Llanfrechfa Grange	4·49	,,	Stewartstown	3·18
,,	Llandovery	5·96	,,	Buncrana	4·95
,,	Castle Malgwyn	5·33			

OCTOBER, 1885.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·73	+ 1·03	·98	23	17	60·9	3	33·4	12	0	5
II.		Maidstone (Hunton Court)...	3·76	+ 1·30	1·24	23	18	...	...	...	...	...	...
,,		Strathfield Turgiss	3·70	+ ·96	·77	23	17	...	...	...	...	...	...
III.		Hitchin	4·99	+ 2·81	·87	23	18	56·0	2	30·0	29	2	...
,,		Banbury	3·67	+ ·91	·65	30	22	58·0	3*a*	30·0	30	2	...
IV.		Bury St. Edmunds (Culford)	4·76	+ 2·59	1·02	6	24	62·0	1	29·0	11*e*	5	...
,,		Norwich (Cossey)	6·86	+ 4·53	1·22	13	25	61·0	16	30·5	30	1	10
V.		Weymouth(LangtonHerring)	3·99	...	·63	21	21	...	...	...	...	...	...
,,		Barnstaple.....	5·68	+ ·23	·73	30	23	60·0	19	39·0	25	0	...
,,		Bodmin	7·56	+ 1·29	·72	30	28	55·0	2*b*	37·0	13	0	1
VI.		Stroud (Upfield)	2·95	— ·06	·49	23	18	60·0	4	32·0	11	1	...
,,		ChurchStretton(Woolstaston)	5·62	+ 1·02	1·20	6	26	57·5	25	34·0	12	0	3
,,		Tenbury (Orleton)	4·04	+ ·80	·96	23	23	59·0	16	27·3	12	5	7
VII.		Leicester	5·44	...	1·25	23	23	63·8	16	30·2	30	2	14
,,		Boston	4·89	+ 2·86	1·54	23	23	57·0	16	33·0	12	0	...
,,		Grimsby (Killingholme).....	6·42	+ 3·77	2·11	23	28	57·0	2	35·0	12*f*	0	...
,,		Hesley Hall [Tickhill].....	4·55	...	1·26	23	23	59·0	4	30·0	30	2	...
VIII.		Manchester (Ardwick).....	5·52	+ 1·09	·75	30	24	58·0	2	32·0	12	1	...
IX.		Wetherby (Ribston Hall) ...	4·82	+ 1·46	·99	24	15	...	...	...	...	...	...
,,		Skipton (Arncliffe)	7·47	+ ·21	1·11	4	25	53·0	17	31·0	29	.	...
X.		North Shields	4·56	+ 2·05	·62	10	22	62·5	1	33·0	21*g*	0	2
,,		Borrowdale (Seathwaite).....	12·79	— 3·76	2·10	25	23	55·9	15	27·9	12	1	...
XI.	WALES.	Cardiff (Ely).....	6·15	+ ·92	1·13	9	19	...	...	...	...	...	...
,,		Haverfordwest	7·42	+ ·97	1·20	21	20	58·0	1*c*	30·0	17*h*	2	2
,,		Plinlimmon (Cwmsymlog) ...	6·90	...	1·47	6	21	...	...	...	...	..	...
,,		Llandudno.....	4·65	+ ·06	·89	6	20	58·1	2	36·0	12	0	...
XII.		Cargen [Dumfries]	4·44	— 1·27	·74	4	16	55·0	2*d*	26·0	25	4	...
,,		Jedburgh (Sunnyside).....	2·27	— ·40	·44	4	23	57·0	2	29·0	13*i*	6	...
XIV.		Douglas Castle (Newmains)	3·80	— 1·14	·95	4	16	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	5·58	— 2·74	·90	4, 25	17	...	...	...	..	...	...
,,		Oban (Craigvarren)	4·06	...	·60	25	18	58·5	15*k*	31·0	22	3	...
,,		Mull (Quinish).....	5·13	...	1·02	25	21	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·70	— 2·61	·50	31	8	...	...	...	...	...	...
,,		Arbroath	1·52	— 1·35	·46	30	11	55·0	1, 5	29·0	25	4	...
XVII.		Braemar	3·26	— 1·22	·57	12	24	53·0	2	17·0	25	11	20
,,		Aberdeen	2·21	...	·50	25	20	56·0	1, 2	26·0	22	5	...
XVIII		Skye (Sligachan)	...	...	...	...	...	...	...	...	...	...	...
,,		Culloden	1·58	— ·71	...	...	...	56·0	2	22·0	23	8	15
XIX.		Dunrobin	3·37	...	·57	25	18	56·0	2	28·0	25	5	...
,,		Orkney (Sandwick)..... ..	4·67	+ ·38	·90	2	23	...	...	...	...	...	...
XX.		Cork (Blackrock)	2·74	— 2·00	·66	29	23	60·0	3, 6	33·0	24	0	...
,,		Dromore Castle	6·99	...	·99	25	21	65·0	25	31·0	22	...	...
,,		Waterford (Brook Lodge) ...	4·43	...	·63	29	17	58·0	8	33·0	23	0	9
,,		Killaloe	4·50	...	·56	20	22	58·0	8	32·0	22*g*	2	...
XXI.		Portarlington	2·92	— ·55	·51	5	23	56·0	3	34·0	24	0	...
,,		Dublin (FitzWilliam Square)	3·50	+ ·08	·99	6	22	57·1	2	33·2	25	0	9
XXII.		Ballinasloe	3·63	— ·80	·66	6	18	52·0	17	30·0	22*g*	4	...
XXIII		Waringstown	3·22	— ·39	·42	25	22	60·0	1	26·0	24	3	10
,,		Londonderry (Creggan Res.).	4·95	...	·80	4	27	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·45	— ·87	·48	25	20	55·0	17	31·0	24	2	4

a And 4, 16. *b* And 3, 5, 6. *c* And 2, 4, 6. *d* And 3, 7, 15. *e* And 29. *f* And 28.
g And 25. *h* And 24. *i* And 25, 30. *k* And 24.
+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON OCTOBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The heavy rains at the beginning and close of the month stopped the sowing of wheat, which was but irregularly done all through the month.

HITCHEN.—Since July, which had an average temperature, we have had the coldest August, the coldest but two September, and the coldest but one October since the record commenced in 1849.

BANBURY.—Mean temp. (44°·8) 4°·5 below the average; fog on 5 days, high wind on 5 days, H on 27th.

CULFORD.—A most uncomfortable month, with continuous drenching rains which delayed the storing of the mangold crop and all out-door work.

COSSEY.—A very cold and wet month.

LANGTON HERRING.—Rainfall ·42 in. above the average of ten years; mean temp. three degrees below the average, and with the exception of 1880 and 1881 the lowest in October during 14 years; the max. temp. was also the lowest in that period. The 9th and 10th were very stormy, the lowest pressure recorded this year occurring on 10th.

BODMIN.—Mean temp. 48°·0.

STROUD.—A very wet and cold October; dense fog on morning of 17th.

WOOLSTASTON.—A cold, stormy month with constant R; mean temp. 43°·8.

ORLETON.—A very cold and rainy month with a few fine days; mean temp. more than 4° below the average of 25 years, and lower than that of any October in that period except 1880; there were several frosty mornings but not severe, and the temp. was uniformly low; fluctuations in pressure were rapid and frequent, wind frequently very strong, especially on 27th; dense fog on morning of 17th; L on 27th and 28th.

LEICESTER.—The month was a very wet one with some very cold nights, the min. on grass twice falling to 22°.

KILLINGHOLME.—A month of almost incessant R, the fall of the 23rd being the heaviest ever recorded here, and the total for the month having been approached only by that of December, 1867, when 6·22 in. fell on 29 days.

MANCHESTER.—A wet month, the R being both heavy and constant; occasional frosts at night, and two or three foggy mornings; T on 5th, severe T and H on 27th.

WALES.

HAVERFORDWEST.—The first half of the month was but a continuance of the excessive wet of the previous one, accompanied frequently at night by H, T, and L; from 15th to 20th fine weather prevailed with slight frosts; a stormy, wet period again set in on 21st, continuing, with a slight break of three days, to the end. Although it blew very strongly at times from N.W. and N.N.E., there were no violent gales. Mean temp. about the average; scarcely any frost.

SCOTLAND.

CARGEN.—The beginning and end of the month were very stormy and wet, and it was the coldest October for many years; mean temp. (44°·0) 4°·4 below the average.

JEDBURGH.—The month was distinguished by the number of days on which R fell, and the prevalence of cold N. and N.E. winds. The weather was cold and ungenial, and owing to the frost and wet, deciduous trees were quite bare at the close; root crops still improving; cereals all secured in good order.

OBAN.—Rainfall moderate, and temp. low, but the weather was seasonable, and the potatoe crop both plentiful and well saved.

QUINISH.—Wet and stormy from 1st to 8th, and from 25th to 30th; sharp frost from 21st to 24th, which broke up on 25th, with very heavy R from S.E. A very bad harvest was finished in this district about the middle of the month, very little grain being left in the sheaves, but the straw in fair order.

BRAEMAR.—A very unsettled month, cold and wet, and the hills covered with fresh S; grass temp. on 25th as low as 9°.

ABERDEEN.—Rainfall of the month about three quarters of an inch below the average; otherwise nothing remarkable to record. Lunar halo on 22nd; H on two days.

CULLODEN.—The weather during the month was unsettled, but there were considerable intervals of dry and favourable harvest weather, which allowed the crops to be safely gathered, except in the Highlands, where they suffered greatly from frost; potatoes free from blight, and an average yield.

IRELAND.

DROMORE.—The beginning of the month was wild and cold, with N.E. winds; the latter part was mild with N.W. winds.

WATERFORD.—A very wet and wild month. S on Mount Leinster on 11th; thick fog on 18th and 19th

KILLALOE.—The general character of the month was normal, and the rainfall was about the average; winds moderate; mean temp., 46°·1, rather lower than usual.

DUBLIN.—A very cold, unsettled, and rainy month, polar winds predominating largely; H showers frequent. Mean temp. (44°·6) 4°·6 below the average, and nearly as low as that of October, 1880 (44°·5), which was the coldest October in 20 years. L on 12th; T on 23rd; lunar halo on 20th; fog on five days. Mean humidity, 88; prevailing winds, N.W.

EDENFEL.—The cold, wet, and unsettled weather which commenced on September 1st did not terminate till October 14th, during which time there were but three rainless days. A fine, calm, and mostly clear period of 11 days, however, followed, enabling what remained of the cereals to be rescued, and the heaviest and soundest crop of potatoes since 1846 to be dug and stored in excellent order. From 25th to 31st the weather was again wet and squally.

PRE-INSTRUMENTAL METEOROLOGY.

WE have never swerved from the opinion expressed many years since in this magazine that considerable service would be rendered to meteorology by the collection of old weather records. We are glad to find evidence that our neighbours in France are of the same opinion. The last number of the *Annuaire de la Soc. Mét. de France*, contains a copy of such records from 1584 to 1781, extracted from the records of the church of Notre Dame de Tonnerre (Yonne), about 100 miles S.E. of Paris. We should be very glad to receive and publish analogous excerpts from British Parish registers.